DOCUMENT RESUME

ED 239 885 SE 043 841

AUTHOR	Hosking, Bunty
TITLE	Life, Beginning and Growing. Teacher's Guide. Unit E1. ZIM-SCI, Zimbabwe Secondary School Science Project.
INSTITUTION	Ministry of Education and Culture (Zimbabwe).; Zimbabwe Univ., Harare. Science Education Centre.
PUB DATE	Aug 81
NOTE	45p.; See SE 043 840 for study guide; for related documents, see SE 043 827-859.
AVAILABLE FROM	University of Zimbabwe, P.O. Box MP 167, Mount Pleasant, Harare, Zimbabwe.
PUB TYPE	Guides - Classroom Use - Guides (For Teachers) (052)
EDRS PRICE	MF01 Plus Postage. PC Not Available from EDRS.
DESCRIPTORS	*Biology; *Cytology; Rats; *Reproduction (Biology); *Science Activities; Science Education; *Science Experiments; Science Instruction; Science Programs; Secondary Education; *Secondary School Science; Teaching Methods; Units of Study
IDENTIFIERS	*Zimbabwe Secondary School Science Project

ABSTRACT

The Zimbabwe Secondary School Science Project (ZIM-SCI) developed student study guides, corresponding teaching guides, and science kits for a low-cost science course which could be taught during the first 2 years of secondary school without the aid of qualified teachers and conventional laboratories. This teaching guide, designed to be read in conjunction with the related student guide, includes instructional strategies, lists of required materials, laboratory procedures, and other information for activities and experiments in a three-part unit focusing on: (1) plant and animal cells; (2) growth and reproduction; and (3) human reproduction. Experiments provided include examining plant and animal cells, preparing models of these cells, and dissecting a rat. Because students may come from traditional homes where various topics in this unit are not discussed (such as human reproduction and family planning), it is suggested that sections containing these topics may be read silently. Each section in this guide corresponds to a given section in the student study guide. (JN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED239885

ZIM–SCI

ZIMBABWE SECONDARY SCHOOL SCIENCE PROJECT

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

✓ This document has been reproduced as received from the person or organization originating it.

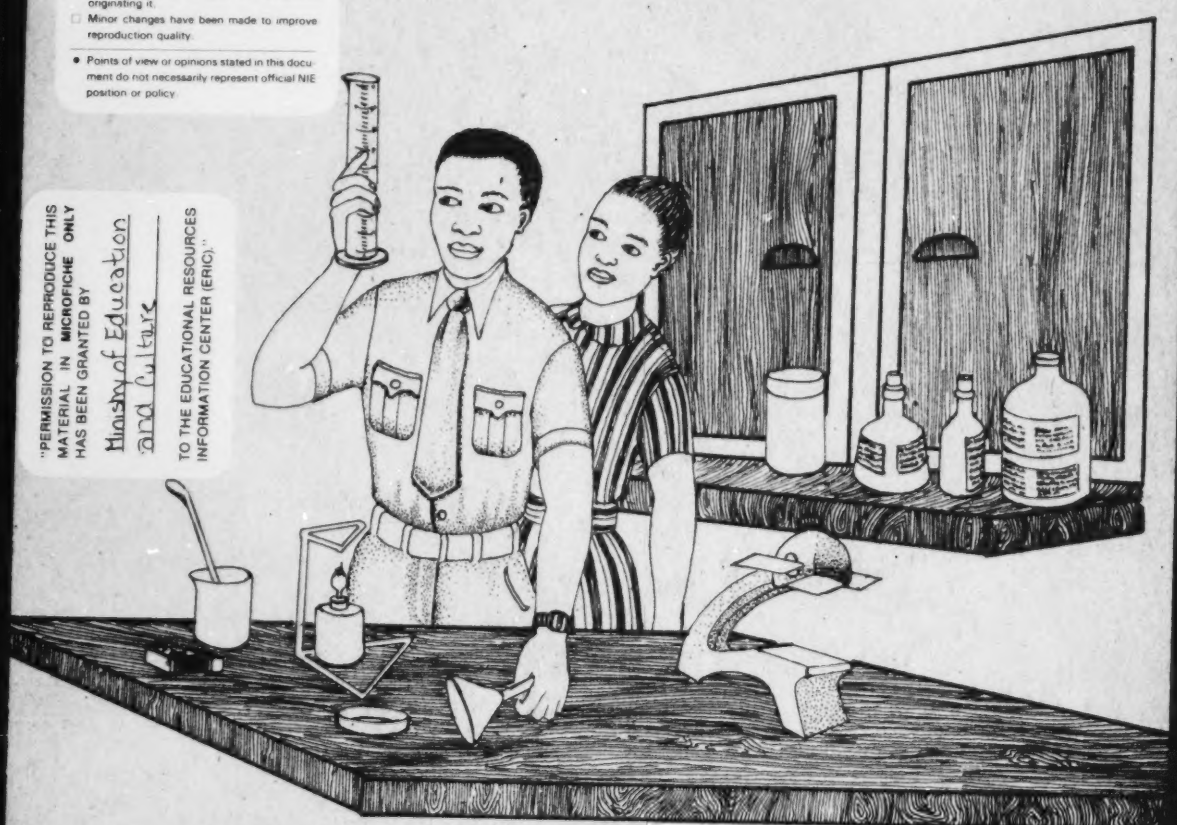
☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

Ministry of Education and Culture

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."



TEACHER'S GUIDE UNIT E1

Life; Beginning and Growing

UNIVERSITY OF ZIMBABWE
AND MINISTRY OF EDUCATION AND CULTURE

SE 043 841

This teaching material is produced jointly by the Science Education Centre, University of Zimbabwe, and the Ministry of Education and Culture.

Copyright is reserved jointly to the University of Zimbabwe and the Ministry of Education and Culture.

None of the material may be produced in whole or in part, by any means, without written permission of the Director, Science Education Centre and the Secretary, Ministry of Education and Culture.

Zim-Sci Team

Alan Dock (Project Leader)
Sue Stocklmayer
Peter Dube
Bunty Hosking
Josie Zesaguli
Gift Jambaya
Mary-Ann Lobb
Dave Wright

Main Writer of this Unit: Bunty Hosking

Acknowledgement: We are grateful for the ready co-operation and assistance we have received from the Audio Visual Department of the Ministry of Education and Culture in the preparation of art work.

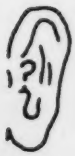
Special Acknowledgement: We are grateful for the valuable help and ideas contributed to the writing of this unit by Dave Smith and Les Cross of Regional Office, Ministry of Education and Culture, Bulawayo.

AUGUST, 1981

The following symbols will be used to indicate the points in the lesson at which teacher activity is particularly important. These symbols also appear at the corresponding points in the pupil study guides.

Practical work. The necessary instructions for each experiment will be given to you when you see this symbol.

Written exercises for the pupils. If possible these should be put on the blackboard before practical work begins so that the pupils can see what to look for.



Teacher information. The pupils will need extra guidance at these points. The information they will need from you is given where you see this symbol.

This symbol appears at a point where it is necessary for pupils to think over what they have done in the past few lessons. Set aside a period for this review activity. Encourage the pupils to read over their notes and the study guide section which they have just covered. It may be helpful to ask them to write a summary too.

The following symbols which appear only in the Teacher's Guide are used to indicate important points for you the teacher.

N.B.

Take note of an important point.

P

This symbol indicates a preparation of apparatus which should be done well ahead of time. Please read these notes carefully and carry out the instructions well in advance.

We have placed this symbol next to experiments where we feel there may be a possible danger. Please read the section carefully so that you know about the particular danger in that experiment. It would also be wise to refresh your memory on the appropriate safety or first-aid procedures described in the Zim-Sci Handbook.

UNIT E1

LIFE : BEGINNING AND GROWING

CONTENTS

	PAGE
Aims	1
Special Note	3
Experiment 1	4
Experiment 2	6
Experiment 3	7
Real cytoplasm	10
Single celled organs	11
Are all plant cells the same?	12
PART 2	15
Why reproduce?	16
Experiment 6	18
Fertilization and the Bream	19
Mating activities	20
Egg diagrams	21
Egg sizes	22
Dissection and care of rat	23
PART 3	31
Human reproduction	32
Human embryos	33
Why does the placenta grow bigger?	34
Chick and human embryos	35
Looking after the young	36
Clinics	37

AIMS OF THIS UNIT

At the end of this Unit pupils should be able to:

1. Identify an animal cell and a plant cell when seen through the bioviewer.
2. List the differences between animal and plant cells.
3. Recognise different types of animal and plant cells.
4. Draw and label the male and female sex cells of animals.
5. Explain how a new animal is formed by the fusion of two sex cells.
6. Explain why animals of the same kind can be slightly different from each other.
7. Explain how external and internal fertilisation happens.
8. Describe the advantages of internal fertilisation.
9. Draw and label the male and female reproductive organs of a mammal.
10. Describe the growth of an embryo.
11. Describe how a baby is born.
12. List the needs of a new born animal and explain how these needs are satisfied for human and other animals.

UNIT E1 : LIFE : BEGINNING AND GROWING

SPECIAL NOTE

N.B.

Reproduction is a delicate subject at all times, especially with a class of mixed teenagers. Many of your pupils may come from traditional homes where this subject is not spoken about. We suggest some parts of this unit could be read quietly by the children. These sections will be clearly shown in this guide. You, the teacher on the spot will be the one to judge how to treat the whole subject as you will know the outlook of the people whose children you teach.

We have left the last section, which includes Planned Families very much to your discretion, but we hope you will not feel obligated to leave it out altogether. If you merely present the facts you should not offend anyone.

If you are unsure, you may wish to consult with the headmaster and other teachers. You could also ask the parents for their views about including a lecture by the Family Planning Association. This Association has some excellent films which present the subject in a very simple manner.

If the pupils ask you questions, try to answer them as straightforwardly as you can. If you find they ask a lot of questions, a visit from the nearest clinic nurse might prove valuable.

We hope that you will enjoy teaching this unit. If there are any areas of difficulty, please write and tell us about them!

THE Zim-Sci TEAM

Please note:

N.B.

On page 5 of this guide you will find Experiment 2, in which you are asked to bring an onion or a bean root to the lesson. Read these instructions straight away because the bean root will take two weeks to prepare.

PAGE 2 : Revision

Ask pupils 'What are the differences between:'

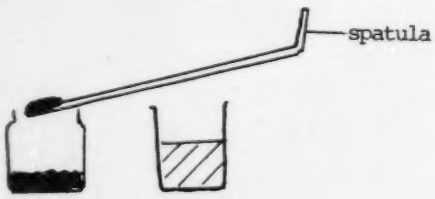
1. Living and non-living things.
2. Plants and animals.
3. Flowering and non-flowering plants.
4. Invertebrates and vertebrates.
5. Fish, amphibia, reptiles, birds and mammals.

Read through the Key in Unit A2 on small animals.

PAGE 3 : EXPERIMENT 1

To make up methylene blue stain:

Measure 25cm^3 of water into a small container, e.g. plastic beaker. Using the spatula/stirrer, dip 1cm of the stirrer end into the methylene blue powder. Lift out a little of the powder.



Add this small quantity to the water and stir well.

The stain should be the colour of ink in the container, but will look a dark blue on the slide. If it is too strong no light can be seen through the slide. If too weak, the methylene blue will not stain the cheek cells properly. It is suggested that you try it out on some of your own cheek cells first. Then you can either add more powder or more water to your solution.

For Experiment 1 you will need:

filter paper
methylene blue stain
methylated spirits

Each pair of pupils will need:

1 microscope slide
1 cover slide
1 mounted needle
Bioviewer
Bioviewer strip JF.102 ONLY
(NOT the Bioset cover with reading material)

Use the stirrer to give the pupils each one drop of the stain onto their slides.

Choose one or two pupils' slides for them to view under the microscope.

Note: If too much liquid is present on a slide, the coverslide may slip about. If your microscope is at an angle this can be a problem with some of the pupils' slides. Keep some filter paper on your desk and if the slide to be viewed is too wet, hold the edge of the paper on the wet edge of the coverslide to take up the excess liquid.

If there is time over at the end of the lesson, it is always a good idea to put some more pupils' slides under the microscope - this will keep up their interest.

P

PAGE 5 : EXPERIMENT 2

You will need:

either (a) an onion or
(b) 20 pieces of bean roots.

(a) Try to obtain an onion. This is easier for you to use and will appear the same as the pupils' biostrip views. If you can obtain one, cut it in half and peel off all the 'leaves'. Cut them up into roughly rectangular pieces as big as possible. You will need one per pair of pupils.

(b) If you cannot obtain an onion you will have to soak and germinate bean seeds. Take about 20 seeds. Soak for 24 hours, then keep damp in wet newspaper for up to 2 weeks (depending on how warm the weather is). Roots should have grown by then. You will need to cut off 20. 1cm lengths of root, the tip of the root being the best part to view.

PAGES 7 & 8 : EXERCISE 1 & 2

Each pair of pupils will need:

Biostrip JG.102 only (not Bioset cover with reading matter)
Bioviewer

After they have completed the sentence at the end of Exercise 2, give them the Bioset covers with reading notes for them to read about the cells.

N. B.

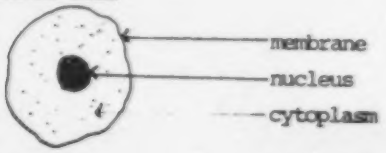
PAGE 8 : Plant cells - special note on EXERCISE 2

The pupils may be puzzled at slide 2, as the plant cell appears to have two dark spots. If they ask about this tell them that one spot is the nucleus, the other is a spot of green colouring material which plants have.

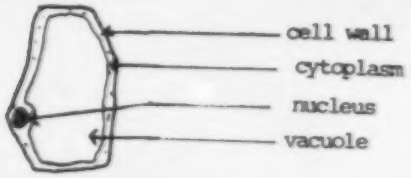
EXERCISES 1 and 2:

Check the pupils labelling. Their diagrams should look like this:

Animal cell



Plant cell



Completed sentences:

An animal cell has three main parts, they are the membrane, the nucleus and the cytoplasm.

A plant cell has a membrane, a nucleus and cytoplasm like an animal cell. It also has a stiff cell wall and cell sap in a vacuole which help keep it a firm shape.

P

PAGE 9: EXPERIMENT 3: To make a model of a simple animal cell.

To make up the soft jelly:

Do this the day before the lesson

You will need:

1 bucket
2 boiling tins (borrow one from a pupil)
spatula stirrer
large plastic bottle
gelatin
balance

Fill the large plastic bottle with water. From this bottle, fill both boiling tins with water. Put one tin on to boil. Place 60 grams of gelatin in the bucket. Add the tin of cold water to the gelatin in the bucket. Stir well. Then add the other tin of boiling water. Stir well until the gelatin is dissolved. Now add the rest of the water from the large plastic bottle. Stir very well. Leave the bucket in a cool place overnight. In the morning you should find the gelatin has set into a soft jelly.

P

To make hard jelly for the 'nucleus':

Place 25g of gelatin in a boiling tin.
Add 25cm^3 of cold water. Stir.
It will set immediately into a solid lump. Remove from the tin at once and break up the lump into 20 pieces about the size of your thumb nail.

You will need for the lesson:

- 20 pieces of thread
- scissors
- iodine solution
- 20 plastic bags
- pins

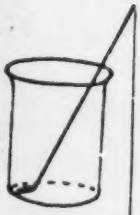
Give each pair of pupils:

- soft gelatin (about 2 small graduated beakers full)
- 1 piece of hard gelatin
- a piece of thread
- a pin or mounted needle
- a plastic bag

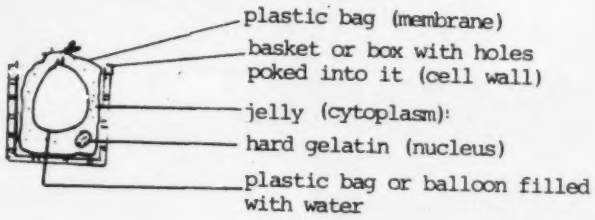
After they have made their models, pass around the scissors for them to cut off their excess plastic.

Now give them 2ml measure of iodine in their boiling tins. After making holes in the plastic, they should be told to put their models into the boiling tins so that the bottom of the model is touching the iodine.

In the next lesson, when the models are examined, the iodine should have diffused into the gelatin through the pinholes. This demonstrates how dissolved substances can pass into a cell through the membrane.



Ideas for making a model of a plant cell:

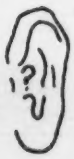

plastic bag (membrane)
basket or box with holes poked into it (cell wall)
jelly (cytoplasm)
hard gelatin (nucleus)
plastic bag or balloon filled with water

The pupils should enlarge on the idea of the animal cell model by suggesting something rigid on the outside, such as a basket or box - you must remind them that holes would be needed in the box for diffusion. A vacuole could be represented by a plastic bag or balloon of water.

PAGE 10 : Showing the pupils real Cytoplasm:

You will need:

1 mounted needle
a fresh egg
2 hand lenses



A hen's egg is a special, large cell consisting of:

1. The yellow yolk (not needed)
2. The white which is the cytoplasm to be shown to the pupils.
3. A white, paper-like, membrane lining the shell itself.
4. A shell.

If you do not want to waste an egg, use it at home and bring to school the two halves of the shell, including about 1 teaspoonfull (5ml) white in each.

The blunt end of the shell shows the membrane well. You should loosen the membrane from the shell edges with your mounted needle.

Pass the egg shells around. Tell the pupils to:

1. Touch the white with their finger tips.
2. Feel the membrane.
3. Examine the shell surface with a handlens and see that it is not smooth.

Tell them to watch the next time a whole egg is put into hot water to cook at home. The shell and membrane have tiny pores and as the cytoplasm expands, dissolved air comes out through them and can be seen as bubbles on the shell surface.

Some pupils may never see an egg being boiled at home. It would be a good idea if you could obtain an egg and demonstrate it to them.

Method:

Boil some water in a boiling tin. Place the egg gently into the water. Small air bubbles can be seen coming from the shell.

PAGE 10 : EXERCISE 3:

Copy down the chart indicating with a tick which characteristics are present in plant and animal cells.

Characteristic	Animal cell	Plant cell
cell wall		(✓)
vacuole		(✓)
cytoplasm	(✓)	(✓)
nucleus	(✓)	(✓)
membrane	(✓)	(✓)
cell sap		(✓)

Complete the following sentence:

In Unit C2, I put a crystal of ----- on top of some gelatin and it passed into the gelatin by -----. Therefore, I expect the iodine to pass into the cell model through the pin holes by ----- too. This demonstrates that food and ----- could pass into the cytoplasm of a cell through the pores in the ----- by the process of -----.

Answers: copper sulphate/ammonium dichromate; diffusion; diffusion; air; membrane; diffusion.

PAGE 11 : Some single celled organisms:

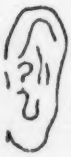
If your straw infusion (Unit A2) was not successful, it may be because the weather was too cold. It is important that the pupils have seen these organisms live, so please try again to make a 'mini pond'. You can make a slide yourself for them to look at under the microscope in this lesson.

Tell the pupils to copy the summary into their books. Point out that this is in the form of a key which they have met before in Unit A2.

PAGE 12 : ARE ALL PLANT CELLS THE SAME?

Ask about:

1. The colour of the leaf compared to the colour of the stem (e.g. green - brown) of a tree.
2. The feel of the leaf compared to the feel of the stem (soft, light - tough, unbending, rough, etc.).



They should decide that the cells in the leaf may be different from the cells in the stem.

Suggest that perhaps there are many different cells in a plant, even in a stem the outside cells may be tougher than the inside ones.

Tell them you will now cut a thin slice of a weed stem. They must decide for themselves by looking at it under the microscope whether these cells are all the same, or some are bigger or differently shaped.

Practise this well ahead of time, as it requires some skill. Read all the instructions carefully before you begin.

You will need:

a white lid(basic kit)
a sharp scalpel
a mounted needle
some water
microscope slides
cover slides
a thin piece of weed stem - no thicker than a pencil. (It must be green and soft - a blackjack is a good weed to choose.)

Place a few drops of water on the lid. Cut the slices so that they fall into the water. You should shave off slices from the stem in the same way that you would sharpen a pencil with a knife. These slices must however be as thin as possible, so that light can pass through them. If they are too thick you will have too many cells to see the different ones clearly. Keep cutting lots of slices. Spread them out into the water with the mounted needle. Look until you find one or two very thin ones. Those with very thin edges are good.

Place a drop of water on a slide. Lift the thinnest slices onto the water on the slide. Lower on a cover slide. Place under the microscope and focus it. Move the slide around looking all over the slide until you find an area where the cells are clear and not jumbled up. Try to find a part similar to slide 5 on the bioviewer strip to show the pupils. You must show two or three different shapes or sizes of cells.

PAGE 13 : EXERCISE 4:

Did you see differently shaped cells in the fresh plant stem? On slide 5 of the biostrip you looked at a section of plant stem. Answer these questions:

1. What do the cells marked (1) do?
2. In what way are they specialized to do this job?
3. In what way are the cells marked (2) different from the cells marked (1)?
4. What job do the cells marked (2) do?
5. What sort of work do the cells marked (3) do?

Answers to Exercise 4:

1. Carry water.
2. They have thick walls and an empty space in the middle.
3. The cells marked (2) are smaller than the cells marked (1).
4. Grow.
5. Carry food around.

PAGE 14 : EXERCISE 5:

Draw:

1. A red blood cell.
2. A white blood cell.
3. A nerve cell.

Label the nucleus, cytoplasm and membrane.

What work is done by:

1. Cheek cells?
2. Red blood cells?
3. White blood cells?
4. Nerve cells?

Answers to Exercise 5:

1. Protect the cheek.
2. Carry oxygen around the body.
3. Trap and eat germs
4. Deal with information or pass messages around.

EXERCISE 6:

Write a short explanation in your own words of:

(a) specialized cells;

(b) tissues;

(c) organs.

Answers to 'How much do you know' : PAGE 15

1. organisms
2. nucleus instructions
3. membrane diffusion
4. cytoplasm
5. cytoplasm vacuole cellsap
6. cell wall
7. work/jobs specialized
8. specialized tissue
9. organ, liver, gut, heart, lungs, brain, kidney, etc.
10. amoeba, paramecium, euglena

PART 2

WHY REPRODUCE?

CLASS DISCUSSION.

If you can find a log of wood showing rings on the cut edge, please bring it to show the pupils. Ask the pupils the following questions and discuss the answers with them:

What is the age of the oldest person you know?

How old do you think some of the big trees in Zimbabwe are?

If you cut down a tree and count the circles in the end of the log you can tell the number of years it has been growing!

If you have a log, you can ask them:

This one is how many years old?
(Pass the log around for the pupils to count. Their answers may not be the same as yours - perhaps two rings are so close as to be thought of as one. Take the most common number given by the pupils as the age.)

Ask them these questions - they should enjoy guessing:

How long do you think animals could live?

How long can insects, fish, birds, mammals live?

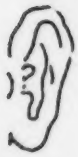
How old is the oldest woman in your village?

How long has your family kept a cow? A hen?
For how long do you think these animals can live?

Here is a list for you of different examples:

a fly	76 days
a queen ant	13 years
a spider	up to 10 years
a cricket	about 1 year
a mosquito	1½ years
a cockroach	4½ years
a mantis	8 years
an earthworm	6 years
fish	2 years and more

(one fish - a sturgeon - which lives in the sea is thought to have been 152 years old when caught!)



a toad	6 years
a swift	1-2 years
an owl	13 years
a chicken	30 years
a duck	31 years
a puffadder	13-14 years
a boomslang	5 years
a crocodile	40 years
a man	68 years
a woman	73 years
an elephant	60 years
a rhino	37 years
a zebra	15 years

You know animals do not live forever. Animals (including people) die from various causes such as:

not enough food (starvation)
disease
being killed (accidently or by other animals)
and of course Old Age

Why do plants die?

Ask the pupils to think of as many reasons as they can. List them in their books.

PLANTS DIE FROM THESE CAUSES:

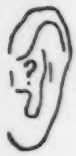
1.
2.
3.
4.
5.
6.

Here are some reasons which the pupils might give:

1. drought
2. cut down for man's use - logs, thatching grass, etc.
3. disease
4. damage by elephants or locusts
5. burnt by fire
6. old age

Please turn over

Tell the pupils:



All living things die. New organisms are needed to replace the old ones. New organisms have to be grown from others of their own kind. When organisms produce more living things like themselves this is called REPRODUCTION.

PAGE 18 : EXPERIMENT 6

Looking at sex cells:

Give out to each pair of pupils:

1 Bioviewer
1 Biostrip (slide strip only from Bioset JG. How animals reproduce)

N.B. EXPERIMENT 6

The true name for a female sex cell is an OVUM. Some confusion may arise in this exercise. The Bioset J.G. calls an ovum an egg, so we have used both terms. You may tell the pupils that one is the common word; egg or egg cell, ovum is the Biological one.

PAGE 18 : EXERCISE 7:

An ovum is the name for a female sex cell, it is commonly called an egg cell.

1. Draw and label the nucleus, head and tail and cytoplasm of a sperm cell.
2. Draw an ovum (female egg cell), label the nucleus and cytoplasm and membrane.
3. Why is the ovum (egg cell) bigger than a sperm?
4. How many sperms can fertilize an ovum?
5. How does the sperm get to the ovum?

Tell the pupils to look at the diagram on page 19 to further understand Fertilization, then complete these sentences in their books:

Fertilization means the ----- of a male ----- and a female ----- each containing a ----- set of instructions.

A whole cell is made with a ----- set of instructions from which a new organism can grow.

Answers:

3. An ovum contains more cytoplasm (food) than a sperm.
4. One.
5. It swims using its tail.

Sentence: the following words fit the blanks

fusing/joining together; sex cell; sex cell; half; complete.

PAGE 22 : Fertilization and the Bream:

Many more sperms are produced than eggs because they are small and weak. Water currents sweep them around and many will not reach an egg. Other animals may eat them. They have very little food supply so cannot swim far, therefore the chances of fertilization are increased if they are laid next to the eggs.

PAGE 24:

Here the pupils are asked to look around and observe mating in animals. A few minutes should be set aside at the beginning of the following lesson for them to tell about their observations (if any).

PAGE 25 : Mating activities:

The first picture shows two male buck fighting to see which is the stronger. The female buck are quietly waiting nearby. The winner of the fight will be the most attractive to the females, and he will be able to have first choice for his mate.

The large bird with its feathers held out is a female ostrich. She is doing a dance to attract a male. The buck and ostrich are showing off in body movements.

Look at the two beetles. The female is giving off a special smell. The male grows special organs - like bushes which can pick up and follow the attractive smell of the female until he finds her.

The toad sitting on a stone at the edge of a pond is blowing out his chest. This acts like a drum and he can make a very loud croaking noise by which he calls females to find him.

In the last two pictures, the male fish on the right and the male bird have developed special breeding colours. At a certain time of the year the male bream gets bright red lines on his fins, and his body becomes darker which attracts the female to him. The male widow bird grows a beautiful long tail and has very fine feathers which attract the plain little female seen next to him. Can you think of any other birds where the male has bright colours and feathers? (Weaver birds, red bishop birds, etc.)

EXERCISE 8:

List the four activities used by animals to attract a mate.

Answers for marking:

1. Movements (buck and ostrich)
2. Smell (beetles)
3. Noise (toad)
4. Colours (birds and fish)

PAGE 26 : EGG DIAGRAM

The pupils may ask what the two string-like objects are between the shell on either side of the yolk. They are thick cytoplasm and keep the yolk in the right place. There is also a membrane separating the yolk from the white to which the string is attached.

Page 28

Read through the questions at the end of the Bioset J.G. 'How Animals Reproduce' with the class, asking them to answer the questions orally.

Here are the answers for you to check as you do this discussion.

ANSWERS TO QUESTIONS ON BIOSET J.G.

How Animals Reproduce

1. A sperm is small and has a tail which enables it to swim towards an ovum (egg cell).
2. The egg is bigger than the sperm. This is because an egg cell (ovum) contains some food.
3. One sperm can get into an egg (ovum) to fertilize it. The other sperms are wasted and will die.
4. After an egg cell (ovum) is fertilized:
   (a) it grows a thick surrounding membrane;
   (b) the nucleus divides into two;
   (c) then the egg cell divides into two.
5. Slides 3 and 4 show the membrane. The fertilized cell divides again and again within the membrane.
6. An embryo is the early stage in an organism's life. It is a very young animal or a very young plant. An embryo can only grow from a fertilized egg. The embryo is shaped like a flat plate in slide 5.

Please turn over

7. The cells around the edge of the embryo grow into blood and tubes (blood vessels) which bring food from the egg yolk to the embryo. The heart, spine (vertebral column), muscles and tail start to grow early on.

8. In slide 7 the head of the embryo has started to develop ears and eyes (organs). The heart and muscles can be seen.

9. Bag (1) is for protection.
Bag (2) is covered with blood vessels and is to bring food to the embryo.
Bag (3) stores waste materials.
The bags grow out of the middle of the embryo.

10. After 7 days the bird embryo has legs, wings, body, tail, head, eyes, ears and a beak. The head is well developed.

PAGE 30: Egg sizes

You may like to ask the pupils which tribe each of the animals belongs to. The answers are of course:

fishes, amphibians, reptiles, birds and mammals.

The eggs and young of birds tend to be larger by proportion to the size of the parents than those of fish, frogs, etc. Birds and mammals are more organised and complicated than fish amphibia and reptiles. Their young are born less developed,

PAGE 32

DISSECTION OF A RAT

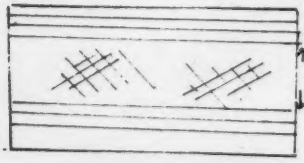
Do not attempt this dissection unless you have obtained a properly bred rat.

NOTE: Wild rats must not be used as they may carry a dangerous disease.

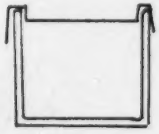
How to look after the live rat until it is needed for dissection:

You will have to keep the live rat in the asbestos trough from your kit.

Cage: The wire fits exactly, lengthwise. You will need to make some bends in it so that it can be wedged into the top of the trough and prevent the rat escaping.



How to fold the wire



Place some clean sand in the bottom of the trough. Obtain a good supply of straw or torn up newspaper and place several handfuls in one end of the trough. Keep food and water at the other end.

Food: Mealie meal, rat cubes, or some sadza will do for the period you will be keeping the rat.

Water: Take a mazoe bottle (clean) and make two holes in the lid by knocking a nail in from the outside. Do not make the holes too big or the water will pour out. Fill the bottle with water. Screw the top on tightly. Lie it on its side in the trough. The rat can stick its tongue in the holes to drink.

Nesting box: A small box for the rat to 'nest' in would be good.

Cleaning: The cage must be cleaned at least once or twice a week, and the soil replaced.

The pupils can be given this job and they will enjoy it, but you must check to see that it is done properly. Also, check that the rat has food and the wire is firmly wedged on again after cleaning.

Killing: It is essential that the animal is killed OUT OF SIGHT OF THE PUPILS. The animal's neck can be broken by holding the shoulders and pulling the head sharply up and out.

While the animal is still warm pin it out on its back (using pins or nails to secure the hands and feet) on a piece of wood.

Note the external sex organs of the animals as shown in the following diagrams A and B:

Ways of telling the sex of the animal before you cut it open:

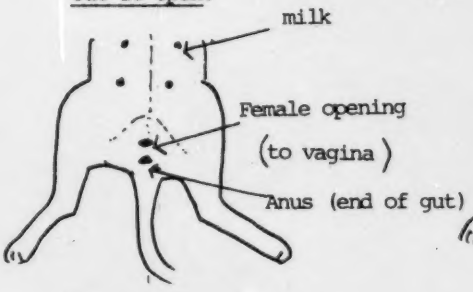


Diagram A

Female - external characteristics

Cutting lines:

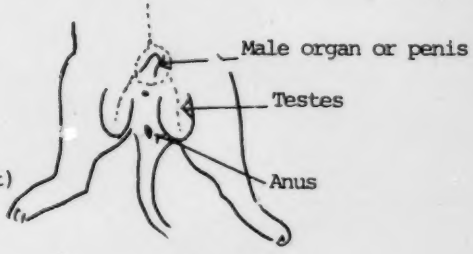


Diagram B

Male - external characteristics

Cutting lines

It may well be difficult to sex young specimens because the sex organs are not well developed. The distance from the male opening to the anus is much further than the distance between the female opening and the anus.

The dissection:

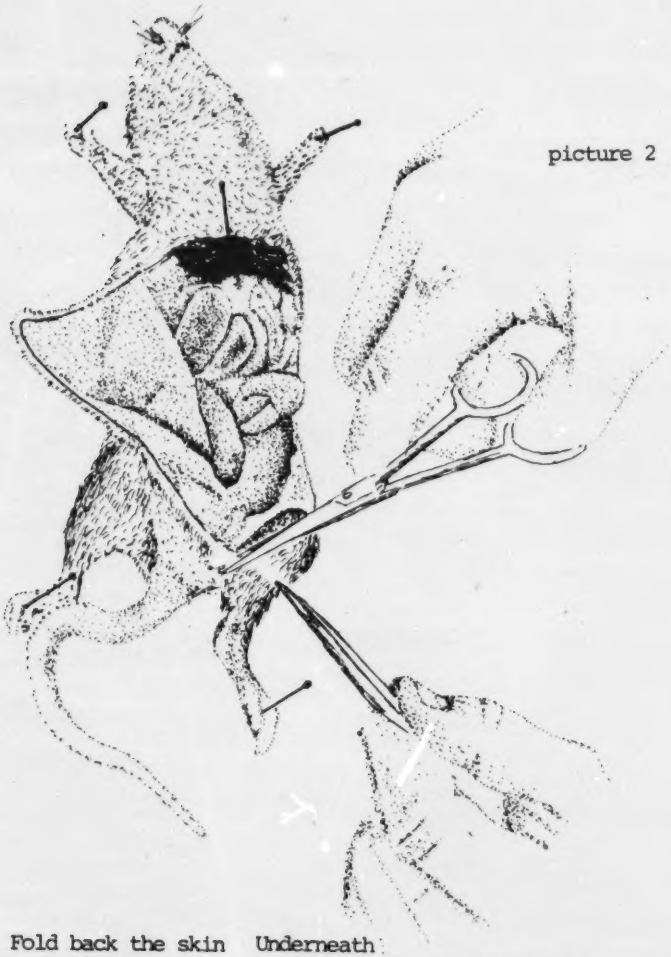
You will need:

forceps
scalpel
pins or nails

scissors

Lift the furry skin between your fingers and make a slit with your scissors. You will now know whether you have a male or female rat. We have shown lines in diagram A (of the female rat) and B (of the male rat) to show you where you should cut. Put the point of the scissors into the skin and cut, being careful to hold the scissors almost horizontal. It helps to keep your elbows close to your body while you work. If you poke the scissors too deep into the rat's body you may accidently cut and damage the gut which will make a horrible smell.

picture 1



picture 2

Fold back the skin Underneath you will see white muscle, which is the body wall. Cut this carefully in the same way as you did the skin and pin it back to the wood. You will now see the rib cage (bones) between the 'arms'. Below this is the dark red liver. The rest of the opening will be filled with the long coiled up gut.

If the rat is a pregnant female you may see the uterus at once, filled with embryos.

The next step in the dissection will be to remove the gut.

The gut is held in place by a thin tissue, like a piece of plastic bag. You will need to cut the gut away from this tissue. Hold the gut tube in your fingers, or use forceps. Separate it from the tissue with your scissors or a scalpel.

Pull all the gut out of the rat's body and lay on one side to show the length to the pupils.

Cut off as much of the gut as possible and remove it.

You will now have an almost empty body.

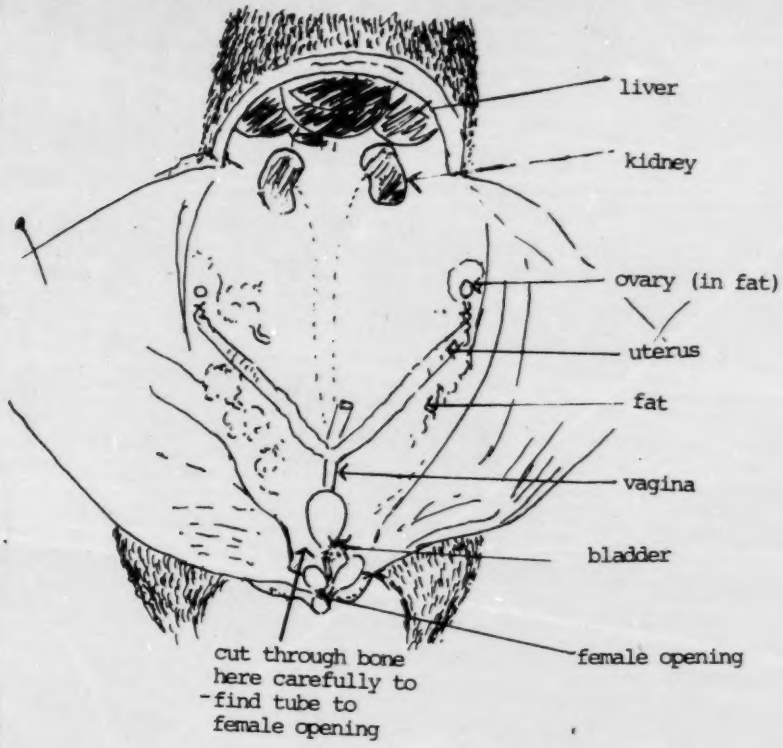
The liver will still be present. Lift up the liver and look underneath it. You will see two kidney organs shaped like beans, dark in colour, and point them out to the pupils.

Cut open the rib cage (bony area between the arms) by cutting through the ribs on one side of the centre bone. Inside you will find the pale pink spongy lungs and dark red heart between. Point these out to the pupils as further examples of organs.

Between the back legs you will find a small bag of liquid - this is the bladder. Be careful not to cut it.

If you have a female rat, follow the instructions for female rat dissection while looking at picture 3 .

If you have a male rat, follow the instructions for a male rat dissection while looking at picture 4 .

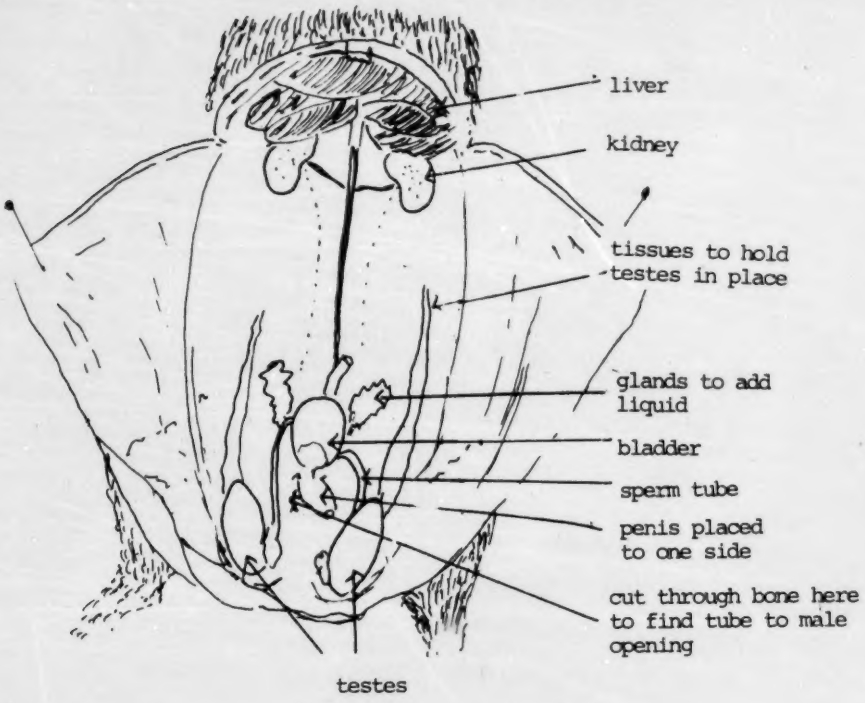


picture 3

Special notes on the female dissection:

If your rat is pregnant, take care not to mix up the gut with the uterus. The uterus will have lumps in it (see pupils' book page 32).

A non-pregnant rat's uterus is quite small. It may have white lumps of fat hanging on it. You will have to take care to find the ovaries which are small and in fat above the uterus. The egg tube is a small coiled tube. The vagina is found where the two arms of the uterus join near the bladder. Carefully cut the bone (see picture and find where the tube from the bladder and vagina lead to the female opening.



picture 4.

Special notes on male dissection:

Cut open the testes bag. Inside you will find two round organs which are the testes. These have long white tissue going up into the body which hold the testes in place. The sperm tubes are thinner tubes and go behind the bladder.. Two wrinkled organs just above the bladder are for making the liquid to add to the sperm.

Using your scissors, carefully cut the bone between the legs where shown in the picture, and find where the tube from the bladder leads to the penis.

PAGE 34 : Answers to 'How much do you know?'

1. Half, information/or instructions
2. Sperms, testes.
3. Egg cells, ova, ovary.
4. Fertilized.
5. External fertilization, fish, frog.
6. Internal fertilization. Insects such as cotton stainer beetle, locust, melon beetle, birds, e.g. fowls, mammals, e.g. rat.
7. Embryo.
8. Food supply.
9. Uterus/womb, placenta.
10. Liquid, tubes.
11. Penis.

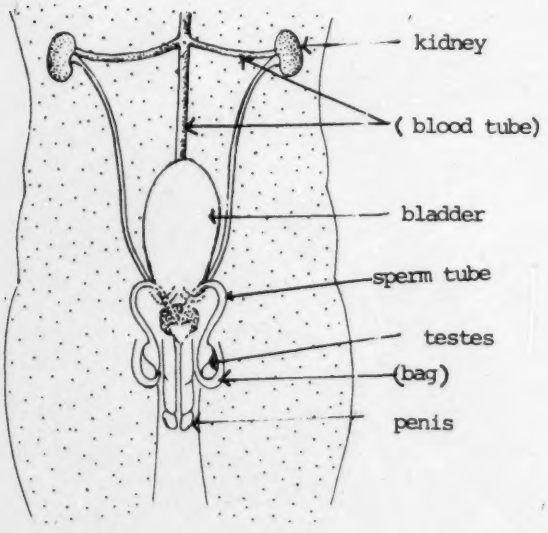
PART 3

PART 3

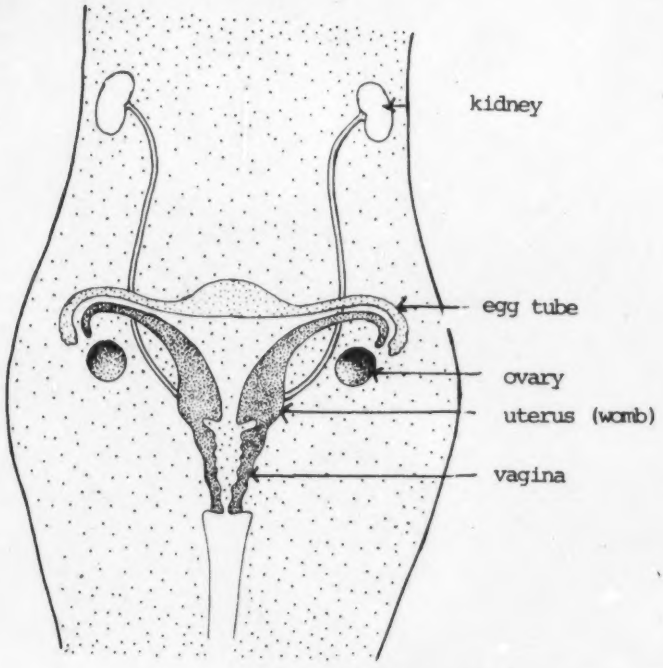
This section deals with human reproduction. If the pupils are shy, you may leave them to read this section silently to themselves.

We have not included diagrams of the human body and reproductive organs in the pupils' guide as it is a sensitive subject. If you wish however, you may give them the diagrams. You could put them up on the board, and ask them to fill in the labels below for themselves after reading 'What happens in Humans'. If they look back to their rat diagrams they should not find this difficult. We leave you to judge the advisability of this exercise.

Labels: testes, sperm tube, penis, bladder, kidneys, vagina, uterus, ovary, egg tube.



MALE REPRODUCTIVE ORGANS



FEMALE REPRODUCTIVE ORGANS

Human embryos

In this section the point to be made is that, from early on in the development when organs start to grow the shape of a human embryo is recognisable. As it grows, it becomes more like the baby the pupils would know. However, it could not survive if it were born too early because the organs, though present are incomplete.

As the baby grows, the organs develop to a stage where the baby can breathe, take in food, move, cry and get rid of wastes.

However, when newly born a baby needs its mother's care because it still cannot:

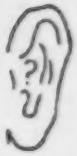
1. See properly - its eyes do not focus.
2. Eat solid food.
3. Walk about.
4. Pick up anything.
5. Keep itself warm.
6. Talk.

It still has to grow up and be cared for for quite a few years. Pupils could compare a newly born human baby with a baby goat or chicken.

PAGE 37 : Why does the placenta grow bigger?

The placenta increases in size to bring more food and air to the embryo as it gets bigger. As a chick grows it uses up the food in the egg, so the yolk gets smaller.

PAGE 39 : Chick and human embryos



These pictures are to show the embryo of a human in the uterus compared to that of a chicken in the egg.
Discuss with the pupils the differences and similarities.

Some ideas on possible discussion points are:

Differences:

1. Protection
   (a) human - uterus wall
   (b) chick - egg shell
2. Food supply
   (a) human - placenta
   (b) chick - yolk
3. Birth
   (a) human - squeezed out through vagina opening at the bottom
   (b) chick - breaks egg shell

Similarities:

1. They both grow in a bag of liquid.
2. They both have tubes from the food supply leading to the stomach area
3. They are both curled up tightly because of the small space, but they can move about a little.

You may, if there is time, ask them to copy the diagram into their books filling in these labels:

Uterus, placenta, bag of liquid, human embryo, tube, vagina, chick embryo, yolk food bag, egg shell.

PAGE 40 : Looking after the young

You may like to read the following to the pupils:

"The Mozambique bream female lays a few eggs (800) in water and the male spreads his sperm around them. After they have been fertilized the female bream picks up the eggs in her mouth. She keeps them there, safe from water animals which like to eat eggs. After they hatch into tiny fish they may swim around near the mother, but they still dart back into the safety of her mouth when in danger. (When their mother finds food, they can often get tiny scraps of food too.)

The Pink Bream does not look after its young so well. After the eggs have been fertilized, they lie in a little hollow in the mud and the male and female both guard the nest and chase off animals which may want to eat them. However, the eggs are not able to be moved away from danger, and the young baby fish are not protected as well as those of the Mozambique Bream. The Pink Bream produce about 6 000 eggs at one time.

The bottom picture is of Tiger fish which have just laid and fertilized one million eggs! After producing the eggs the male and female swim away and have nothing more to do with them."

EXERCISE 9:

Fill in the chart:

Fish	Type of Care Given	Number of eggs
M. Bream	Eggs & young fish protected in mother's mouth. Very good.	800
Pink Bream	Parents guard eggs in nest. Good	6 000
Tiger Fish	Eggs left alone. No care.	1 000 000

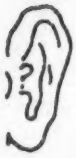
Answer this question:

Why does the tiger fish need to lay so many more eggs than the Pink Bream or the Mozambique Bream?

Answer: Because the tiger fish gives no care or protection to the eggs, and many will be eaten. A large number have to be laid in the hope that a few may survive. When a lot of care is taken, as in the Mozambique Bream, few eggs are needed, as they all stand a good chance of surviving.

Therefore, this shows that the greater the care given to the young, the fewer young need to be produced.

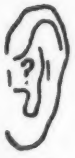
PAGE 41 : Care of the young



Fish/amphibia and reptiles do not have the means to keep their own body at a certain temperature, so they cannot really keep their eggs warm in the same way as do birds and mammals. Their temperatures depend on the surroundings. It will often be found that while not actually themselves producing warmth, the time of the year at which eggs are laid will be warm. Here again you can point out the number of eggs depends directly on the amount of care, as in the Bream and tiger fish.

PAGE 42

Information on clinics that may be interesting for the pupils:



There are two kinds of clinics in Zimbabwe. The one which will be most familiar to the pupils is the kind which dispenses medicines. Anyone can attend this kind of clinic when they are sick.

The second kind is called a 'Wellbaby' clinic and here mothers are taught how to care for their babies. At these clinics, babies should have injections which prevent children getting diseases such as measles, mumps, whooping cough, polio, diptheria, smallpox and tetanus.

Please turn over

When a girl is about twelve years old, she should have an injection to prevent 'German measles'. This disease is not harmful to a small child, but is very dangerous to a developing embryo. Therefore, a girl should make sure that there is no chance of her getting this disease when she is pregnant. An injection when she is twelve will guard her future babies.

Note: The effect of the disease on the embryo is that it prevents the eye organ developing properly. The baby may be born blind.

Other points to note:

Clean water and clean toilet habits help prevent diarrhoea and vomiting.

Cleanliness at birth and a special kit for sealing off the tube to the placenta after a baby is born saves many babies' lives. Dung should never be put on a new born baby. It carries bad germs.

Proper food for babies is very important. If a woman has a second baby too soon, the first baby does not get mother's milk, which is clean and good, for long enough. Sadza alone does not supply enough proper food for that child to grow properly. It may get 'Kwashiokor'. Symptoms of this are dull eyes, quietness, a big belly and 'reddish' hair. Often children who have suffered this way too long do not grow up strong and clever. So it is better for mothers to space their children and not have them too close together in age.

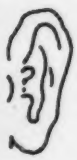
If people have many children new problems arise. How are the parents going to keep on supplying all the needs of those children?

A good way to organise this discussion is to divide the class into two groups. Ask one group to represent a large family (about ten children) and the other group to represent a 'planned family' of three children. Each group must make a list of the needs of the family, and roughly price the expenses per month on each. This could form a project over a few days. Typical needs might be:

Food: meat, maize, milk, bread, sugar tea.

Clothing: suggest the children find the cost of a set of school clothes for a girl and a boy.

Furniture: beds and blankets, etc.



Education: people have to contribute towards their education in books, pencils, transport, etc.

After the children have prepared their lists, a comparison could be carried out between the two groups.

Also remind the children that if a man has many children he and the country do not have enough land for everyone. They must go to the towns to work. Strong, healthy or well educated people usually get good jobs with more money.

Money in the hand of a farmer means that he can buy fertilizer for his land and make the land more fertile to grow more crops for himself and for his country. Too many children means less money for this, poorer crops and less food for all.

Money in the hand of a townsman means that he can buy goods for his house and his family, thus helping the industries of the country. Too many children means less goods for the whole family.

Last points for discussion:

Remind the pupils that they have already found out scientifically that water from dams and rivers is likely to contain organisms that could make them ill. Borehole or tap water is safer. Other water must be boiled to kill harmful organisms.

They have seen from the strange plants that grew on old damp bread that 'seeds' of plants and other organisms are all around them and can make food go bad if it is left lying around. Food should be kept covered.

Point out that many insects carry disease. Flies should be kept away from food to stop them sitting on it with feet which may have been in dung. Mosquitoes bring malaria. Water should not be left lying around because mosquitoes breed in water.

So, in learning science, they will be able to help their own children to become stronger and healthier one day.

Printed by the Government Printer, Harare